

REMARKS

The Office Action dated November 26, 2007, has been received and carefully noted. The above amendments and the following remarks are being submitted as a full and complete response thereto. Claims 26-45 are pending in this application. By this Amendment, claims 33-40 are amended for clarification purposes only. No new matter has been added. Reconsideration of the application is respectfully requested.

Entry of this Amendment is proper under 37 C.F.R. § 1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issues requiring further search and/or consideration on the part of the Examiner as the Amendment merely clarifies the claimed features of the invention; (c) satisfy a requirement of form asserted in the previous Office Action; (d) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (e) place the application in better form for appeal, should an appeal be necessary. The Amendment is necessary and was not earlier presented because it is made in response to objections raised in the Final Rejection. Entry of the Amendment is thus respectfully requested.

The Office Action rejects claims 31, 33-34 and 37-40 under 35 U.S.C. § 103(a) as being obvious over Asakawa et al. (U.S. Patent No. 5,795,385) in view of Zhang et al. (U.S. Patent No. 5,766,344); claims 26-30, 35-36 and 41-45 under 35 U.S.C. § 103(a) as being obvious over Asakawa in view of Zhang and further in view of Selvakumar et al. (U.S. Patent No. 5,633,194); and claim 32 under 35 U.S.C. § 103(a) over Asakawa in view of Zhang and further in view of Ahn et al. (U.S. Patent No. 5,470,619). The rejections are respectfully traversed.

In particular, the above-identified application claims a crystalline silicon film forming method that includes preparing a film forming apparatus, locating a substrate in a silicon film forming vacuum chamber and forming the pre-film of the crystalline silicon film on the target surface of the substrate over a length, in a first direction, of the target surface by the film forming device while emitting an ion beam to the target surface to form the pre-film having a crystallinity, and producing the intended crystalline silicon film from the pre-film by irradiating the pre-film in the vacuum chamber with an energy beam, as recited in independent claim 33, and similarly recited in independent claims 34-40. Furthermore, the above-identified application also claims that the energy beam is selected from the group consisting of a laser beam and an electron beam, as recited in independent claims 33-38.

Asakawa teaches forming a single-crystalline thin film on a polycrystalline substrate using plasma CVD by forming a downwardly directed, mainly neutral, neon atom current by an ECR ion generator (Abstract). Asakawa further teaches previously forming an amorphous thin film or a polycrystalline thin film, and then irradiating the thin film with “beams of atoms or molecules” (column 4, lines 32-35). Accordingly, the thin film in Asakawa is formed before the irradiation. Because Asakawa clearly teaches that the thin film, which the Office Action associates with the claimed pre-film (Office Action, page 2, lines 12-14), is formed before it is irradiated, Asakawa fails to disclose or suggest forming the pre-film of the crystalline silicon film on the target surface while emitting the ion beam, as recited in the independent claims. Furthermore, the claims affirmatively recite that the pre-film is formed by emitting an ion beam. As discussed above, the irradiation in Asakawa is an irradiation with “beams of atoms or molecules”

(column 4, line 35) and is not an ion beam irradiation. Thus, Asakawa fails to teach emitting an ion beam from the ion source to form the pre-film, as recited in independent claims 33-40.

Additionally, the independent claims clearly recite that the pre-film is formed while emitting an ion beam, and the intended crystalline silicon film is formed by irradiating the pre-film with an energy beam. The Office Action indicates that the energy beam is suggested by Asakawa (Office Action, page 2, lines 15-16). However, a closer examination of Asakawa reveals that the energy beam referred to by the Office Action is in fact the same beam of atoms or molecules that is used to crystallize a portion of the thin film. Alternatively, the Office Action also refers to the beams of low energy gas that are used to form a single crystalline thin film (column 4, lines 54-65). However, in this different embodiment of Asakawa, the low energy gas beams in Asakawa utilize the law of Bravais to sequentially convert the thin film to a crystal (column 5, lines 4-7). This embodiment in Asakawa only teaches that a thin film is formed using plasma chemical vapor deposition, but does not teach the prior step of first irradiating the thin film with an ion beam before irradiating the substrate with beams of the low energy gas because Asakawa specifically teaches for this embodiment that “no crystallization of the prescribed material with the plasma chemical vapor deposition” is allowed (column 4, lines 59-60). Accordingly, this different embodiment of Asakawa also fails to disclose or suggest the features of independent claims 33-40. Also, with respect to independent claims 33-38, Asakawa teaches a “low energy gas” and thus fails to disclose or suggest that the energy beam is selected from the group consisting of a laser beam and an electron beam.

Finally, in the section titled "Response to Arguments," the Office Action asserts that Asakawa teaches scanning the substrate in a first and second direction (Office Action, page 7, lines 6-10). However, the Office Action is mistaken because Asakawa merely teaches scanning the substrate "in a plurality of prescribed directions of incidence," using a substrate moving means to form a single crystalline thin film having high homogeneity (column 10, lines 10-27), and also teaches with reference to Figure 62 using a moveable table 706 horizontally slidably supported by a table 702 and a seating portion provided with a horizontal driving mechanism to horizontally drive an upper member of the moveable table 706 and a direction for sliding the seating portion that is perpendicular to that for sliding the upper member (column 59, lines 9-27). Asakawa also teaches with reference to Figure 63 that the substrate 11 can be scanned along two orthogonal directions by action of the two horizontal driving mechanisms (column 59, lines 28-31). However, although Asakawa teaches the ability to scan a substrate along two orthogonal directions, Asakawa fails to teach forming the pre-film while emitting the ion beam over a length, in a first direction, of the target surface of the substrate to form the pre-film and irradiating the pre-film with the energy beam while moving the substrate in a linear second direction crossing the first direction, as recited in the independent claims. In other words, Asakawa fails to teach that the ion beam is emitted over the length, in one direction, of the substrate, and the substrate is moved in another direction that crosses the one direction. Asakawa merely teaches that the scanning can be done in two orthogonal directions but does not teach that the scanning is done over the length in one direction while movement of the substrate is done in

another. Applicants respectfully remind the Patent Office that these two steps are affirmatively recited in the independent claims and should be considered as such.

For at least these reasons, Asakawa fails to disclose or suggest the features of independent claims 33-40.

The Office Action admits that Asakawa fails to disclose or suggest an energy beam consisting of a laser beam or an electron beam and relies on Zhang to disclose or suggest this feature. However, Zhang teaches a preparing method of a polycrystal semiconductor film with good electrical properties (Abstract), and fails to cure deficiencies in Asakawa in disclosing or rendering obvious the above-discussed features of independent claims 33-40. Furthermore, a combination of Asakawa and Zhang would result in the apparatus of Asakawa including an additional source of laser beam or electron beam while, as discussed above, Asakawa only teaches a beam of atoms or molecules or, alternatively, a low-energy gas beam, but always teaches a single beam. Accordingly, adding the laser beam of Zhang to the apparatus of Asakawa would render Asakawa inoperative for its intended purpose. Thus, a combination of Asakawa and Zhang fails to arrive at the subject matter of the independent claims.

Selvakumar teaches a low temperate ion-beam assisted deposition process (Abstract), and fails to cure the above-discussed deficiencies in Asakawa and Zhang in disclosing or rendering obvious the features of independent claims 33-40.

Ahn teaches a method for the production of polycrystalline silicon thin films (Abstract), and also fails to cure the above-discussed deficiencies in Asakawa and Zhang in disclosing or rendering obvious the features of independent claims 33-40.

For at least these reasons, claims 33-40 are patentable over a combination of all of the applied references. Furthermore, claims 26-32 and 41-45, at least for their dependence on patentable claims 33-40, and for their added limitations, are also patentable over the applied references. Accordingly, claims 26-45 are patentable over all the applied references, and withdrawal of the rejections of the claims under 35 U.S.C. § 103(a) is respectfully requested.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300, **referencing Attorney Dkt. No. 107351-00011**.

Respectfully submitted,



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Attachment: Petition for Extension of Time (one month)